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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/509,303

06/22/2005

Satoshi Aoki

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EXAMINER

GARDNER, SHANNON M

ART UNIT

PAPER NUMBER

1795

MAIL DATE

DELIVERY MODE

09/01/2010

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/509,303	<b>Applicant(s)</b> AOKI, SATOSHI	
	<b>Examiner</b> Shannon Gardner	<b>Art Unit</b> 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 08 June 2010 (Amendment).
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 2 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 2 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)                        | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Amendment***

Applicant's amendment of 6/8/2010 does not render the application allowable.

### ***Remarks***

Applicant has amended claim 2. Currently, claim 2 is pending in the application and is considered on its merits below.

### ***Status of Objections and Rejections***

All rejections from the previous office action are withdrawn in view of Applicant's amendments. New grounds of rejection necessitated by the amendments are set forth below.

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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3. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bayon et al. (*Preparation of Indium Hydroxy Sulfide  $\text{In}_x(\text{OH})_y\text{S}_z$  Thin Films by Chemical Bath Deposition*) in view of Birkmire (US 5674555) and Nakada et al. (*High-Efficiency Cadmium-free  $\text{Cu}(\text{In}, \text{Ga})\text{Se}_2$  Thin-Film Solar Cells with Chemically Deposited ZnS Buffer Layers*).

As to claim 2, Bayon is directed to a method of fabricating a thin-film compound solar cell wherein the buffer layer is formed by chemical bath deposition using an aqueous solution for dipping, the buffer layer in the first and second steps being formed by regulating the pH of the aqueous solution (of indium(III) chloride, acetic acid, and thioacetamide) in the range 1 to 3.5 (Bayon teaches a pH of about 3) to obtain a deposition rich in InS and the buffer layer in the third step being formed by regulating the pH of the aqueous solution in a range higher than 3.5 to obtain a deposition rich in InOH-InO, the structure of the buffer layer changing in response to the change in pH (see title; pp 2775, column 1 **Experimental** section, and column 2 **Results and Discussion** section). The Examiner notes that a *prima facie* case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties (MPEP 2144.05) and thus Bayon's teaching of a pH higher than 3 (pp 2775, column 3, 5th paragraph) renders the pH in the range of 3.5 to 12.0 obvious. Further, the Examiner notes that Bayon is directed to the formation of indium hydroxyl sulfide thin films by chemical bath deposition in an aqueous solution of indium(III) chloride, acetic acid, and thioacetamide where in concentrations of acetic acid and thioacetamide

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concentrations were varied to obtain different growth rates and layer thicknesses (pp 2775, 1<sup>st</sup> column 3<sup>rd</sup> paragraph) which inherently affects the pH of the solution.

Though Bayon teaches a CIGS light absorbing layer (Introduction), the reference fails to teach a layer of In-Cu-Ga being formed by a sputtering process and then heated in a selenium (Se) atmosphere to form a CIGS light absorbing layer.

However, it is known in the prior art to sputter a Cu-Ga-In layer and follow that step with selenization (a heated Se atmosphere) in order to form a CIGS light absorbing layer (column 5, lines 14-67) wherein heterojunctions are formed by a CBD formation of a buffer layer (column 6, lines 17-23) as taught by Birkmire as a well known CIGS formation method.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to form the CIGS absorber layer of Bayon by well-known methods in the art such as sputtering a Cu-Ga-In layer followed by a selenization step as taught by Birkmire.

Bayon is silent as to the regulation of the temperature of the aqueous solution during the formation of the layer and as to the formation of a transparent electrode by a sputtering process after the formation of a buffer layer.

However, it is known in the solar cell thin-film art to fabricate a thin-film compound having an n-type buffer layer (Nakada - Introduction pp 2093) formed therein for providing a heterojunction with a p-type semiconductor light absorbing layers (CIGS)

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(pp 2094, section II(B)) formed on a back electrode wherein, the buffer layer is formed on the light absorbing layer (pp 2093, section II (A)) wherein the CBD process (being continuously stirred – pp 2093, section II(A)) comprises a first step of holding the solution with the light absorbing layer surface dipped therein at a first preset temperature for a first preset time (room temperature) (pp 2093, section II (A)), a second step of heating the solution for a second preset time to a second temperature higher than the first temperature (pp 2093, section II (A)) and a third step of holding the solution at the second temperature for a third preset time (80°C) (pp 2093, section II (A)) as taught by Nakada to monitor the growth rate and particle size of the thin-film. Nakada teaches the aqueous CBD solution's temperature rising from room temperature to 80°C (pp 2093, section II(A)). During this temperature rise, there will be an intermediate temperature reached at some time that will be higher than the first temperature. The time at which the CBD begins reads on the instant first preset time, the time at which CBD is concluded reads on the instant third preset time, and the time at which the intermediate temperature is reached reads on the instant second preset time. Nakada goes on to teach the sputtering of a transparent conducting ZnO:Al film after the formation of a buffer layer (pp 2094, 2<sup>nd</sup> column, 1<sup>st</sup> paragraph).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to monitor/regulate the temperature of the aqueous solution of Bayon as taught by Nakada in order to monitor the formation of the thin film and to form a transparent electrode by a sputtering process as such is a well known formation method in the solar cell art.

Further, monitoring both the temperature and/or the pH of the solution is considered routine experimentation to one skilled in the art and therefore it would have been obvious to try varying temperatures/pH values in the method taught by modified Bayon (MPEP 2141 II).

The Examiner asserts that the combination of Bayon in view of Birkmire and Nakada teaches a process of forming a buffer layer substantially equivalent to that of the instant claim and therefore, the process of the prior art will provide a buffer layer that is formed by depositing particles gradually being larger in grain size in the direction departing from the light absorbing layer surface.

#### ***Response to Arguments***

4. Applicant's arguments filed 6/8/2010 have been fully considered but they are not persuasive:

Applicant argues that "Both Bayon and Nakada fail to describe the forming of a buffer layer comprising lower side deposition of particles being rich in InS and smaller in grain size toward the light-absorbing layer side and the upper side deposition of particles being stepwise larger in grain size and being rich in InOH·InO toward the transparent electrode side" (pp 5 of Arguments).

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5. The Examiner respectfully disagrees. The combination of Bayon and Nakada teaches the steps of the instant method - including the monitoring of both pH and temperature of the method. These parameters are the direct cause of the grain size of the particles as well as the "richness" of either InS or InOH·InO in the buffer layer. There is no requirement that a person of ordinary skill in the art would have recognized the inherent disclosure at the time of invention, but only that the subject matter is in fact inherent in the prior art reference (see MPEP § 2112 II). Further, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

### ***Conclusion***

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of



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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

***Contact/Correspondence Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shannon Gardner whose telephone number is (571)270-5270. The examiner can normally be reached on Monday to Thursday, 5am-3pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571.272.1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. G./

Examiner, Art Unit 1795

/Alexa D. Neckel/

Supervisory Patent Examiner, Art Unit 1795